



EFFECT OF RECIPROCAL-PEER-TUTORING ON ACADEMIC ACHIEVEMENT OF SENIOR SECONDARY SCHOOL PHYSICS STUDENTS

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ABSTRACT

This study investigated the effect of Reciprocal peer tutoring (RPT) strategy on senior secondary school students' achievement in Physics in Enugu Education Zone, Enugu State. The influence of gender on the achievement of students was explored. The study adopted a pretest, posttest, non-equivalent control group quasi-experimental research design. The sample for the study comprised of 167 Senior Secondary One Physics students selected using the purposive sampling from two co-educational schools located within the education zone. Data were collected using Physics Achievement Test constructed by the researchers and validated by experts in measurement and evaluation to ascertain the validity of the instrument. The reliability of the test was ascertained using the Kuder-Richardson (K-R) 20 formula and a reliability coefficient of 0.76 was obtained. Data collected were analyzed using mean and standard deviation and analysis of covariance at 0.05 probability level. Result of the study indicated that students taught Physics using Reciprocal peer tutoring strategy performed better than their counterparts taught Physics using the lecture method. Based on these findings, it was recommended that RPT strategy should be adopted by Physics teachers at secondary school level in order to enhance students' academic achievement.

Keywords: Reciprocal Peer Tutoring, Achievement and Physics.

INTRODUCTION

Education is an activity aimed at fostering and equipping individuals with appropriate skills, abilities and competencies that will enable the individual to develop and also contribute meaningfully to the development of the society. Therefore, the aims and objectives of education cannot be realized without fully developing the individual skills in whom the society depends on for its advancement and development. The acquisition of the skills, abilities and competences cannot be achieved without effective teaching and learning (Agube, Ntibi & Neji, 2021). Education at all levels and in all its forms constitutes a vital tool for addressing virtually all global problems. Education is not only an end in itself. It is a key instrument for bringing about changes in knowledge, values and behaviors and life styles required to achieve sustainability and stability within and among countries (Abubakar, 2013, Bajaj & Chiv, 2009). Science is an intellectual activity carried out by



man in order to discover useful information about the natural world in which humans live to also discover the strategies in which information can be organized into meaningful pattern. (Gottlieb, 2012). Science has become such an indisputable tool that no nation, developed or developing, wishing to progress in the socio-economic sphere will afford to relegate its learning in schools. Nigeria has also endeavored to raise the standard of science teaching through curriculum development. Science in the secondary schools is taught through two main categories; Basic Science at the basic secondary level and the separate science subjects as Chemistry, Physics and Biology at the senior secondary school level. Physics, the most fundamental and the root of every field of science (Erylmaz, 2010) is defined by Anyakoha (2007) as a natural science that involves the study of matter and energy and their interactions. This is because Physics being one of the core subjects offered in Nigeria schools forms the basis for the nation's technological advancement and human resources (Abubakar, 2012). Physics is one of the scientific subjects taught at the senior secondary school (SSS) level in Nigeria. Nigeria as a developing nation requires Physics as regards to technological and scientific development to meet up with other developed nations. Physics being one of the basic science subjects has being described as a scientific study of properties of matter, motion, energy and their interactions (Eze, 2010). In other words, Physics is a physical science subject that is concerned mainly with matter as it relates to energy which also deals with the study of laws that determine the structure of the universe. Josiah (2012) stated that Physics facilitates the understanding of other disciplines. In the relation above, Olaniyan, Omosewo, and Nwankwo (2015) was of the opinion that Physics provides the basic knowledge and understanding of principles of learning and its applications contribute immensely to the quality of life in the society. Man needs enough science for the sake of self-reliance and survival. This particular need of man comes from the knowledge of Physics which is aimed at equipping the individual to understand the importance of Physics in the area of communication, transportation, health and agriculture among others.

Consequent upon this, researches in Physics have paved way for many inventions and discoveries, such as electricity, conductors, magnetism, and others which have made possible the inventions of modern conveniences, such as television, computers, equipment used in performing medical application which includes computer tomography, x-ray machines, ultra-sonic imaging, laser surgery, incubators and global positioning satellite and other business and home technologies, all are product of Physics.

The importance of Physics as a yardstick for technological advancement cannot be over-emphasized. Therefore, there exist a link between progress in Physics and technological advancement of the society. Fortunately, it has been discovered that, Physics is needed for scientific and technological development worldwide in both developing and developed countries alike. Physics education on the other hand can be defined as the educational methods currently used to teach physics. Physics education deals with sharing of science content and process with individuals who are not considered traditionally to be member of the scientific community; the individuals could be students, farmers, market



women or a whole community. Physics education in Nigeria concentrate on the teaching of science concepts, method of teaching and addressing misconceptions held by learners regarding science concepts.

Physics education is very important to the development of any nation and that is why every nation must take it very serious in all institutions of learning. Many of the developed worlds were able to achieve so much in science in science and technology because of physics education. Launching of sputnik by the Russian government in October, 4 1957 would not have been possible if not for the position they placed physics in physics education. Eraikhuemen and Augustine (2014) observed that without adequate foundation and knowledge of Physics in our schools, scientific and technological advancement in Nigeria would remain a mirage. In spite of the importance of Physics to personal and National development, evidence abounds in literature that Nigerian students still perform poorly in the subject (Steven, 2010). Some of the roles played by Physics to development are in area of electronics, food processing, preservation and storage as well as fuel and electricity production. Stressing the importance of Physics, Ale and Adetola (2011) asserted that the line of demarcation between developed and developing countries is based on the level of their Physics attainment and ingenuity to apply the concept of Physic smartly. The Registrar of National Examinations Council (2010), commenting on Nigerian students' mass failure in science (particularly Physics; 29.49% noted that "unless there is improvement in teaching and learning in schools, there is little examination bodies could do to salvage the bad situation (Ikirima, 2016). This situation calls for the reforming of methods and practices of science teaching especially Physics in Nigeria to make it more learner-centered.

In recognition of the consequences of student's under-achievement in physics and the effects of using lecture method in teaching the subject, it becomes imperative to adopt an innovative instructional strategy in order to enhance student's academic achievement, address the learning needs of students individually and also promote creative and reflective thinking in scientific and problem-solving situations. In the light of the above, alternative teaching strategies are being sought to enhance teaching and learning of the subject. Reciprocal peer tutoring is an innovative teaching and learning instructional strategy. Uwameiye and Aduwa-Ogiegbaen in (Olawoyin, 2015) defined Reciprocal peer tutoring as a teaching strategy in which student of the same class and age bracket undertake the teaching of physics concepts for themselves. One student among the group teaches other students. It is also described to mean a procedure that enables each member in a group to participate in the group as a tutor. Also, according to Esteve (2005), reciprocal peer tutoring (RPT) could be defined as a learning situation where students take turns acting as the tutors and the tutees for instruction or review of academic material. In this case, students exchange roles during tutoring session, both giving and receiving academic assistance while the teacher supervises rather than participate in the intervention. The students' dialogue among themselves as each learner acts in response to another. The dialogue is usually structured by the use of four strategies, sometimes known as the



Fabulous Four (Oczkus, 2003), which are predicting, clarifying, questioning and summarizing. The goal of reciprocal peer tutoring is to use discussion to enhance students' physics achievement, develop self-regulatory and monitoring skills, and achieve overall improvement in motivation (Allen, 2003). Pigott, Fantuzzo, Heggie and Clement, (1984) developed and tested reciprocal peer tutoring for children with academic needs. In this procedure, students are assembled in groups of two or more and are trained to work together to prompt, monitor and evaluate each other, while working toward group goals. The students alternate between the roles of tutor and tutee in groups. Students work together in the groups to achieve established goals or rewards that are contingent upon group achievement. RPT requires that the students earn points for correctly responding to academic task. RPT requires each member of the group to contribute to the attainment of the goal, and ensures that no one person can be responsible for the group success (Esteve 2005).

The effect of reciprocal peer tutoring strategy on gender on academic achievement was also determined. Gender disparity in physics education has remained a matter of great concern to researchers. Nwagbo (2006) cited in Arop et al (2015) stated that apart from factors such as teaching method, and the teacher, gender is also implicated in students' achievement in science. Many researchers have conflicting assertions on the effect of gender on academic achievement. While many researchers agree that there is no disparity in achievement in science between male and females (Offor 2012; Aniodoh & Offor, 2014, Adebule, & Ayoola, 2016), the same cannot be said for some others who believes that the males are higher achievers than the females.

RPT is based on Vygotsky's (1978) social cognitive theory which emphasizes the role of social interaction (dialogue) in the development of cognition. Cognition is the mental action or process of acquiring knowledge and understanding through thought, experience, and the senses. Vygotsky believed that thinking aloud and discussion of thoughts aid clarification and revision of thinking and learning. Vygotsky's theory of Zone of Proximal Development (ZPD) is believed to be critical in identifying appropriate text and scaffolding activities to support students success (Galloway, 2001). Vygotsky (1978: 86) explained ZPD to mean "...the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers". Though reciprocal peer tutoring has some research evidence in support of its potential effectiveness in some western countries (Fantuzzo, King & Heller, 1992; Malome & McLanghlm, 1981; Fisher, 2001; Allen, 2003; Oczkus, 2003; Esteve, 2005), little studies seem to be available here in Nigeria. RPT was considered based on the fact that the strategy helps the students to participate actively in teaching and learning and also helps the teacher to identify the learning needs of individuals and their knowledge deficits. Therefore, it is important that this strategy be tried out Enugu Education Zone to determine its effectiveness in improving the physics achievement of secondary school students in adopting reciprocal peer tutoring as an instructional strategy.



PURPOSE OF THE STUDY

The purpose of this study was to investigate the effect of reciprocal peer tutoring on the academic achievement of senior secondary school physics students in Enugu Education Zone of Enugu State.

Specifically, this study sought to determine the

1. mean achievement scores of students taught Physics using Reciprocal peer tutoring and those taught using lecture method.
2. mean achievement scores of male and female students taught physics using Reciprocal peer tutoring.
3. interaction effect of method of teaching and gender.

RESEARCH QUESTIONS

Three research questions were posed to guide this study:

1. What is the mean achievement scores of SS1 students taught Electricity using Reciprocal Peer Tutoring and those taught with conventional lecture method?
2. What is the mean achievement scores of male and female SS1 students taught Electricity using Reciprocal peer tutoring.
3. What is the interaction effect of methods and gender on students mean achievement scores in Electricity?

HYPOTHESES

The null hypotheses formulated to guide the study at .05 level of significance included:

1. There is no significant difference in the mean achievement scores of SS1 students taught Electricity using Reciprocal Peer Tutoring and those taught with the conventional lecture method.
2. There is no significant difference in the mean achievement scores of male and female SS1 students taught Electricity using Reciprocal peer tutoring.
3. There is no interaction effect between gender and methods of teaching Electricity.

METHOD

The design for this study is non-equivalent pretest-posttest treatment and control group design, with the experimental group adopting a reciprocal peer tutoring approach and the control group using the conventional approach. Intact classes were used in the study in order not to disrupt the normal class structure. The target population of the study consisted of all the senior secondary one (SS1) Physics students in all the public secondary school in Enugu education zone of Enugu State, the choice of SS1 was due to the fact that the basic concept of electricity which contains these topics to be taught is in the scheme of work of this class. Nigeria. According to Research and Statistics Department Post Primary School Education Board (PPSMB, 2022), the total population of SS1 Physics students in public schools in Enugu Education Zone is five thousand one hundred and nine five (5,195) students. Out of this figure, one thousand nine hundred and eighty four (1,984) are male,



while three thousand six hundred and three (3,603) are female. The sample size for this study consisted of one hundred and sixty-seven (167) senior secondary one (SS1) Physics students drawn from two (2) intact classes out of twenty (21) co-educational secondary schools in Enugu education zone. Purposive sampling technique was employed in drawing the sample for the study. The researcher sampled one local government area from the three local government areas in the zone. Simple random sampling was employed to draw all the co-educational secondary schools to take care of gender variables in the study. The aim of using co-educational senior secondary schools is because the study considered gender as a variable. From the co-educational senior secondary schools in the Local Government Area, the researcher drew one school that has a stream of SS1 physics student. One instrument named Physics Achievement Test (PAT) was used for collection of data. The 40 item PAT had sections A and B. Section A consisted of information on demographic variable of the students' gender, while section B comprised of 40 items multiple-choice objective test in Electricity with 4 options lettered A-D. The PAT was constructed by the researcher, who later subjected the instrument for face and content validity by experts in Physics education and educational Measurement and Evaluation. The reliability of PAT was ascertained by administering the test to 35 SS1 Physics students who were not part of the sampled subjects; and a reliability coefficient of 0.76 was obtained using Kuder-Richardson K-R20 formula.

The instrument was administered to students in both experimental and control groups as pretest, before treatment to determine their knowledge level. Physics teachers from the selected schools who were briefed, for one week were used as research assistants. The experimental group subjects were taught Electricity using Reciprocal peer tutoring strategy, while lecture method was used to teach the same topics to the sampled subjects in the control group. The treatment lasted for a period of six weeks. Items in the pre-test were rearranged and administered as post-test to the same students in both groups, in order to determine the effectiveness of the treatment on students' academic achievement in Physics.

RESULTS

Research question 1: What is the mean Achievement Score of SS1 Students taught Electricity using Reciprocal Peer tutoring and those taught with lecture method?

Table 1: Mean Achievement Scores of Students taught Electricity using Reciprocal Peer tutoring and those taught with Lecture method.

Group	N	Mean	SD	Mean
Pretest RPT	89	13.02	3.92	16.23
Posttest RPT	89	29.25	6.17	
Pretest lecture	78	16.18	5.59	11.35
Posttest lecture	78	27.53	5.06	



Table 1 indicates that the mean achievement scores of SS1 Physics students taught electricity with lecture method was 11.35 while the mean achievement scores of Physics students taught using reciprocal peer tutoring (RPT) strategy was 16.23. The result revealed that the mean achievement score of students taught with RPT is greater than that of students' taught with lecture method.

Research question 2: What is the mean achievement score of male and female SS1 students taught electricity using reciprocal peer tutoring and those taught with lecture method?

Table 2: mean achievement scores of male and female of SS1 students taught electricity using reciprocal peer tutoring and those taught with lecture method.

Group	N	Male		N	Female	
		Mean	Mean Gain score		Mean	Mean Gain score
Pretest RPT	30	13.89	15.53	48	12.21	17.54
Posttest RPT	36	29.42		53	29.75	
Pretest lecture	30	14.26	12.12	48	17.62	9.94
Posttest lecture	36	26.38		53	27.56	

Table 2 revealed that the mean achievement score of SS1 students taught electricity with conventional method for both male and female were 12.12 and 9.94 respectively while their mean achievement scores using reciprocal peer tutoring (RPT) method for both male and female were 15.53 and 17.54 respectively. The result showed that in as much as both gender performed better after the use of RPT in teaching them electricity the females performed more use after the of RPT. That means the use of RPT was highly effective on female students.

Research question 3: What is the interaction effect of method and gender on students mean achievement scores in electricity?

Table 3: Mean interaction effect of method and gender of students mean achievement scores in electricity.

Factor	N	Gender	Mean	SD	Mean gain score
Control	30	Male	13.90	5.48	0.25
	48	Female	17.60	5.23	
Experimental	36	Male	14.03	3.11	1.17
	53	Female	12.34	4.28	



Table 3 revealed that the interaction effect of students when taught electricity with method was 0.25 while interaction effect when taught electricity with reciprocal peer tutoring (RPT) method was 1.17. This result revealed that interaction effect when RPT was used was greater than the interaction effect when lecture method was used.

Hypothesis 1: There is no significant difference in the achievement scores of SS1 students taught electricity using reciprocal peer tutoring and those taught with lecture method.

Table 4: Analysis of covariance between the mean achievement scores of SS1 students taught electricity using reciprocal peer tutoring and those taught with lecture method.

Source	Type II Sum of Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	420.127 ^a	4	105.032	3.383	.011	
Intercept	9079.651	1	9079.651	292.479	.000	
Pretest	215.306	1	215.306	6.936	.009	
Method	252.148	1	252.148	8.122	.004	Significant
Gender	22.015	1	22.015	.709	.401	
Interaction	6.632	1	6.632	.214	.645	
Error	5029.083	162	31.044			
Total	140554.000	167				
Corrected Total	5449.210	166				

The result in Table 4 shows that there is a statistically significant difference between the mean achievement scores of students taught electricity using RPT and those taught with lecture method. This is because the p-value of .004 associated to F-ratio of .709 is less than the level of significance (0.05). Based on the above, the null hypothesis is rejected. There is a statistically significant difference between the mean achievement scores of students taught electricity using RPT and those taught with lecture method.

Hypothesis 2: There is no significant difference in the achievement scores of male and female SS1 students taught electricity using reciprocal peer tutoring and those taught with lecture method.

The result in Table 4 shows that there is no statistically significant difference between the mean achievement scores of male and female SS1 students taught electricity using reciprocal peer tutoring. This is because the p-value (.401) is greater than the level of significant (0.05). Based on the above, the null hypothesis is not rejected, implying that



there is no significant difference between the mean achievement scores of male and female students taught electricity using RPT.

Hypothesis 3: There is no interaction effect between gender and method of teaching in teaching electricity among SS1.

The result in Table 4 shows that there is no statistically significant interaction effect between gender and method of teaching in teaching electricity among SS1 students. This is because the p-value of .645 associated to F-ratio of .214 is greater than the level of significant (0.05). Based on the above, the null hypothesis is not rejected, implying that there is no statistically significant interaction effect between gender and method of teaching in teaching electricity among SS1 students.

DISCUSSION OF FINDINGS

The result of this study revealed that RPT is more effective in enhancing the academic achievement of students in physics. The variation in the achievements recorded by both the experimental and control groups can be attributed to the potency of the teaching strategy adopted in each group. Thus, a significant positive effect exists in favour of the experimental group because of the treatment. Thus, the finding of this present study was found to be in consonance with the findings of Uwameiye and Aduwa-Ogeibean (2006), Jibrin and Zayum (2012) and Magpanay (2016) which indicated that Reciprocal peer tutoring improved the academic achievement of students more than the lecture method (Jibrin & Zayum, 2012). The reason that may have contributed to the effectiveness of reciprocal peer tutoring in this study is the fact that the use of RPT provides the students with a more suitable environment to learn and serves to create interest. More so, RPT has been found to enhance students' performance more than conventional method.

The finding also showed that there was no significant difference in the mean achievement scores of male and female students taught electricity with RPT. this finding is in agreement with Yadav and Bajpai (2016), Uroko(2010) and Oviawe (2010) that gender has no significant effect on student's performance of those taught electricity with RPT. It is also in line with the findings of Jibrin and Zayum (2012) that there were no significant difference in academic achievement of male and female students taught electricity with RPT. it also disagrees with Mujtala and Ress (2013) who concerted that girls are superior over boys in academic achievement. In the other hand Marchand and Taasooobshirazi (2013) reported that boys perform better. While Uwem and Macmillan (2016) that there exist difference in gender achievement in physics and other science subjects for the females. Reason may be as a result that both male and female students' are well taught with RPT, they internalize learning and conveniently apply it. The students were exposed to the same learning instructional materials and they exhibited similar abilities indicating benefit from the study. Students taught with RPT made a remarkable improvement in their academic achievement than their counterparts that were taught with conventional method.



Another major finding is that there is no interaction effect of gender and teaching method on students' academic achievement in electricity. This finding appeared to be consistent with those of Uroko (2010), Nwosu and Ndanwu (2020), Oviawe (2010) who found no interaction between teaching method and gender among students in teaching and learning electricity. This means that the teaching method (RPT) did not combine with gender to affect students' academic achievement.

CONCLUSION AND RECOMMENDATIONS

Based on the findings of the study, it was concluded that Intervention using reciprocal peer tutoring strategy significantly improved Physics achievement of SS1 students. However, students in the experimental group taught Electricity concept using reciprocal peer tutoring strategy had a higher mean achievement score; they performed better than students in the control group. This indicates the effectiveness of reciprocal peer tutoring in improving achievement in Physics. It was therefore recommended that:

1. Teacher preparation institutions should incorporate reciprocal peer tutoring strategy in the relevant areas of their curriculum units and expose both the pre-service and in-service teachers to these techniques of teaching and learning. This would involve instructing teachers on the basic concept of reciprocal peer tutoring strategy, the designing and development of RPT strategy training programmes and how best to train the learners in the various types of learning strategies. This exposure will help to develop in the teachers the competencies necessary for helping the students to effectively use the RPT strategy.
2. Federal and State Miniseries of Education and relevant professional associations interested in the problems of learning in schools should organize seminars/workshops and conferences on the importance of reciprocal peer tutoring strategy as an aid to students' learning; the designing and development of reciprocal peer tutoring training programmes, and procedures in training learners in the use of the strategy. This is necessary because many of the practicing teachers may not be familiar with the skills involved in reciprocal peer tutoring strategy, not to talk of teaching students how they can be effectively applied in learning.
3. Male and female students should be exposed to training in reciprocal peer tutoring strategy without discrimination, since the evidence is that the use of the strategy significantly improves their achievement in Physics.

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